CLAIMS

What is claimed is:

1. An optical switch for selectively directing light with a certain set of spectrum from a first fiber to a second fiber or to a third fiber and directing light with another set of spectrum from said first fiber to said third fiber or to said second fiber, said second fiber and said third fiber being located adjacent to each other along a longitudinal axis, said optical switch comprising along said longitudinal axis in sequence from said first fiber to said second and third fibers:

a) a first lens for guiding light from said first fiber and to said second or third fibers;

b) a first block of birefringent material for separating and combining mutually orthogonal polarizations;

c) a first compound half-wave plate for rendering mutually parallel polarizations orthogonal and mutually orthogonal polarizations parallel;

d) a first compound polarization rotator whose polarizations rotation can be electrically controlled;

e) a fist wavelength filter whose polarization rotation is wavelength dependent;

f) a polarization-dependent beam path deflector;

g) a second wavelength filter whose polarization rotation is wavelength dependent;

h) a polarization-independent beam angle corrector;

i) a second compound polarization rotator whose polarizations rotation can be electrically controlled;

j) a second compound half-wave plate for rendering mutually parallel polarizations orthogonal and mutually orthogonal polarizations parallel;

k) a second block of birefringent material for separating and combining mutually orthogonal polarizations; and

l) a second lens for guiding light to said second or third fiber from said first fiber, wherein said second fiber and third fiber are placed adjacent to each other to form a dual collimator and exit said second lens at an angle θ with respect to said longitudinal axis.

2. The optical switch of claim 1 wherein said beam corrector is a glass prism that provides a beam a receiving angle for fiber in dual fiber collimator.

3. The optical switch of claim 1 wherein said polarization-dependent beam path deflector comprises two tapered birefringent plates.

4. The optical switch of claim 1 wherein said first and second compound polarization rotators comprise a 45° Faraday rotator, and said Faraday rotator is coupled to electromagnets.

5. The optical switch of claim 1 wherein said first and second compound polarization rotators comprise a 90° Faraday rotator.

6. A compound polarization rotator assembly according to claim 5 comprises a first switchable 45° Faraday rotator that is coupled to an electromagnet and a second permanent 45° Faraday rotator, the said second Faraday rotator comprises either a latching garnet plate or a garnet plate saturated by a permanent magnet.

7. A Faraday rotator assembly according to claims 4 and 6, wherein said magnetic field applying means is formed by a coil and an electromagnet formed of semi-hard magnetic material.

8. The optical switch of claim 1 wherein said first and second compound polarization rotators are selected from a class of garnet materials characterized by having a saturation field of less than 500 Oe.

9. The optical switch of claim 1 wherein said first and second compound polarization rotators comprise an electro-optic retarder.

10. The optical switch of claim 1 wherein said first and second compound polarization rotators are selected from a class of ferroelectric materials characterized by having a Curie temperature of less than about 600° C and having a Vπ of less than about 600V.

11. The optical switch of claim 1 wherein said first and second compound polarization rotators are selected from a class of solid organic materials characterized by having a Vπ of less than about 600V.

12. The optical switch of claim 1 wherein said first and second blocks of birefringent material, said beam deflector, said tapered plates, and said wavelength filters comprise a material selected from the group consisting of rutile, calcite, and yttrium orthovanadate.

13. A reflection mode optical wavelength switch for selectively directing light with a certain set of spectrum from a first fiber to a second fiber or to a third fiber and directing light with another set of spectrum from said first fiber to said third fiber or to said second fiber, on the same side of said first fiber said second fiber and said third fiber being located adjacent to each other along a longitudinal axis, said optical switch comprising along said longitudinal axis in sequence:

a) a first lens for guiding light from said first fiber and to said second or third fibers;
b) a second lens for guiding light to said second or third fiber from said first fiber, wherein said second fiber and third fiber are placed adjacent to each other to form a dual collimator and exit said second lens at an angle with respect to said longitudinal axis;
c) a block of birefringent material for separating and combining mutually orthogonal polarizations;
d) a compound half-wave plate for rendering mutually parallel polarizations orthogonal and mutually orthogonal polarizations parallel;
e) a compound polarization rotator whose polarizations rotation can be electrically controlled;

f) a polarization-independent beam angle corrector;

g) a wavelength filter;

h) a polarization-dependent beam path deflector;

i) a prism reflector.

14. The said prism deflector of claim 13 is a total reflection right angle prim.

15. The reflection optical switch of claim 13 further comprises a beam displacement prism located in front of said first lens for increasing the separation between said first lens and said second lens.

16. The reflection optical switch of claim 13 wherein the said compound polarization rotator is a 45° rotator.

17. The reflection optical switch of claim 13 wherein the said compound polarization rotator is a 90° rotator.

18. The reflection optical switch of claim 13 wherein the said compound halfwave plate further comprises a compensation plate that is configured to compensate for optical path length difference between an ordinary ray and an extraordinary ray in the said block of birefringent material.

19. A reflection mode optical wavelength interleaver for directing light with a certain set of spectrum from a first fiber to a second fiber or to a third fiber and directing light with another set of spectrum from said first fiber to said third fiber or to said second fiber, on the same side of said first fiber said second fiber and said third fiber being located adjacent to each other along a longitudinal axis, said optical switch comprising along said longitudinal axis in sequence:

a) a first lens for guiding light from said first fiber and to said second or third fibers;

b) a second lens for guiding light to said second or third fiber from said first fiber, wherein said second fiber and third fiber are placed adjacent to each other to form a dual collimator and exit said second lens at an angle with respect to said longitudinal axis;

c) a block of birefringent material for separating and combining mutually orthogonal polarizations;

d) a compound half-wave plate for rendering mutually parallel polarizations orthogonal and mutually orthogonal polarizations parallel;

e) a polarization-independent beam angle corrector;

f) a wavelength filter;

g) a polarization-dependent beam path deflector;

h) a prism reflector.

20. A reflection optical switch for directing light from a first fiber to a second fiber or to a third fiber, on the same side of said first fiber said second fiber and said third fiber being located adjacent to each other along a longitudinal axis, said optical switch comprising along said longitudinal axis in sequence from said first fiber to said second and third fibers:

a) a first lens for guiding light from said first fiber and to said second or third fibers;

b) a block of birefringent material for separating and combining mutually orthogonal polarizations;

c) a compound half-wave plate for rendering mutually parallel polarizations orthogonal and mutually orthogonal polarizations parallel;

d) a compound polarization rotator whose polarizations rotation can be electrically controlled;

e) a polarization-independent beam angle corrector;

f) a polarization-dependent beam path deflector;

g) a prism reflector.

21. The reflection optical switch of claim 20 wherein the said compound polarization rotator is a 45^{o} rotator.

22. The reflection optical switch of claim 20 wherein the said compound polarization rotator is a 90° rotator.